Chemistry 350 Spring 2018
28 points Due date Friday, March 9, 2018

Problem Set 4 – Systematic Approach to Equilibria, Buffers

Complete all problems on separate paper. Show all work for credit. Correct use of significant figures is required for full credit. Identify any assumptions you make in solving the problems.

1. An acidic solution containing 0.010 M La^{3+} is treated with NaOH until $La(OH)_3$ precipitates. At what pH does this occur?

2. In a 0.030 M solution of the weak base, B, 0.27% of B underwent hydrolysis to make BH^+. Find K_b for the base.

3. Write the charge and mass balance expressions for each solution below. Ignore autoprotolysis of water. (4 points each)

    a. 0.100 M in H_3PO_4 : Write the charge balance expression and one mass balance expression.

    b. 0.100 M in HNO_2 and 0.0500 M in $NaNO_2$: Write the charge balance expression and two independent mass balance expressions.

    c. 0.100 M $Ca(NO_3)_2$ saturated with CaF_2 (s) : Write the charge balance expression and one mass balance expression.

4. What is the pH of a solution prepared by mixing 20.0 mL of 0.100 M HCl with 150 mL of 0.150 M sodium acetate. Assume volumes are additive. K_a for acetic acid is 1.75×10^{-5}.

5. Describe how you would prepare 0.500 L of 0.100 M imidazole buffer, pH 7.50, starting with imidazole hydrochloride, $pK_a = 6.99$. Assume you also have 1.00 M NaOH and 1.00 M HCl at your disposal. (*hint: 0.100 M refers to the total "imidazole" concentration)*